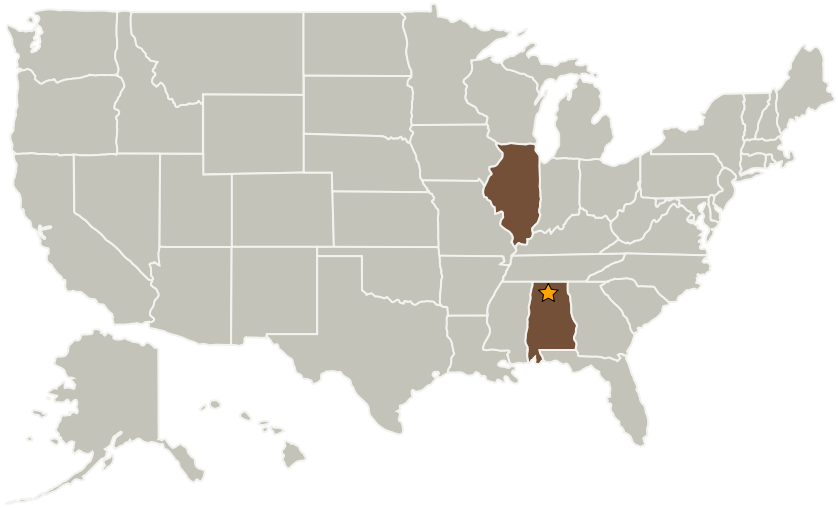
Multi-Phase Flow Analysis Tools for Solid Motor Applications, Phase I

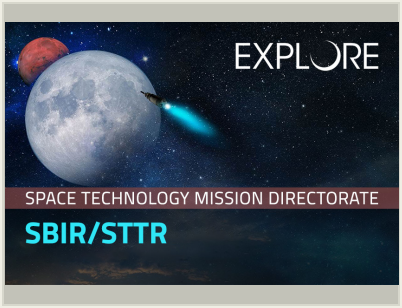
Completed Technology Project (2008 - 2009)

Project Introduction

The challenges of designing, developing, and fielding man-rated propulsion systems continue to increase as NASA's Vision for Space Exploration Program moves beyond the Space Shuttle and RSRM. The number and type of different propulsion elements required are significant, and predicting internal solid motor behavior and characteristics and assessing external environments due to plume impingement on vehicle structures is a top priority. Solid motors do not require pre-start thermal conditioning but can be throttled by grain shape and pintle design, and thus the analysis tools must be flexible and prepared to meet the appropriate simulation readiness level. Our proposed innovation will enhance existing engineering software by combining new flow solution methodologies with appropriate boundary conditions to create a novel toolset for complex multi-phase solid rocket analyses. The innovation will be based on the LOCI/CHEM multi-physics analysis package and will utilize new LOCI features, new multi-phase flow models, and theoretical and phenomenological boundary conditions to create a unique software tool for solid propellant burning, particle breakup, surface erosion, and environment characterization for next generation solid motors. Our research products will provide NASA with the important capability to simultaneously analyze solid propellant combustion, heat transfer, and nozzle erosion within a single numerical framework.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Tetra Research Corporation	Supporting Organization	Industry Women-Owned Small Business (WOSB)	Princeton, Illinois

Primary U.S. Work Locations	
Alabama	Illinois

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Rex Chamberlain

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.4 Solids